

Testing Neutrino Anomalies with LArTPCs

In recent years, experimental anomalies have been reported from a variety of experiments studying neutrinos. The puzzling results from these experiments may suggest the existence of physics beyond the Standard Model and hint at exciting new physics, including the possibility of additional low-mass sterile neutrino states. Definitive evidence for sterile neutrinos would be a revolutionary discovery, with implications for particle physics as well as cosmology. The primary goal of my current research is devoted to new experimental efforts that could eventually solve this puzzle.

My research concentrates on accelerator neutrino physics at Fermilab, contributing to the short-, mid- and long-term efforts in the field, by actively participating in the efforts to develop liquid argon detector technology in the context of the Intensity Frontier Program. The completion and operation start-up of the 170 t liquid Argon MicroBooNE detector and beyond that the LAr1-ND project for sterile neutrino studies at Fermilab, the completion of the analyses in the main physics topics from ArgoNeuT data (cross sections measurements in exclusive channels and nuclear effects in neutrino interactions) and the realization of the LArIAT experiment at the Fermilab Test Beam Facility will be the key-steps of my activity during the next years.

My short-term activity in MicroBooNE and LArIAT will be dedicated to the major effort of timely preparing all the reconstruction tools needed at the start-up of the data taking in 2014. Progressing with the development of more and more accurate reconstruction tools for LAr data analysis is a fundamental step toward future neutrino oscillation LArTPC experiments. I intend to put my experience, gained from the reconstruction and analysis of ArgoNeuT data, to construct a coherent effort on LAr TPC event reconstruction software development. This development, in combination with larger mass LAr-TPC detectors and the use of cold electronics (MicroBooNE and future LAr detectors like LBNE) is an important step for accurate topological analysis of LAr TPC neutrino events, on the line pioneered by ArgoNeuT. At the same time, I am utmost interested in finalizing the detector design for the new "small-scale" LArTPC detector (LAr1-ND, 80 t LArTPC) acting as a near station on the BNB beam, whose realization turned out to be an essential element for the build up of a short-baseline oscillation physics program at Fermilab - with large physics opportunities and potentialities in the short/mid term (thanks to the same technology to be used on a longer time scale for the long-baseline physics). My main effort in the next year, as LAr1-ND co-Spokesperson, will be devoted to finalizing the detector design while refining the physics reach and continue to building the LAr1-ND collaboration.